Development and Characterization of the Timepix X-ray Sensor Assembly (TXSA)

Completed Technology Project (2018 - 2021)

Project Introduction

Hard X-rays (HXRs) from bremsstrahlung are the most direct available diagnostic of solar flare electron acceleration. This acceleration is thought to occur as a transfer of energy from the magnetic fields of the solar corona into energetic particles, though the exact nature of the acceleration is not understood. To investigate flare particle acceleration, innovative new instruments will fly on CubeSats and other platforms to observe the Sun. These instruments will require detectors sensitive to X-rays up to ~100 keV with an energy resolution of a few keV or better, and with low background rates. Cadmium Telluride (CdTe) is an attractive material for these purposes because it can typically be operated at temperatures requiring only passive cooling. This is particularly attractive for CubeSats that don't have room for mechanical coolers or consumables. A specific future mission for which this development is intended is the Miniature X-ray Imager (MiXI). The MiXI concept is a HXR imager aboard a CubeSat that will observe flares and active regions in Solar Cycle 25. MiXI will produce images and spectra of flares and will be optimized for co-observation with the STIX instrument on Solar Orbiter, in order to observe HXR flares from multiple vantage points. The TXSA development will supply the needed detector for MiXI and will also be useful for other solar HXR instruments. This proposal describe the development and testing of the HXR Imager detector assembly based on the Medipix/Timepix detectors. The Medipix is a family of photon counting and particle tracking detectors developed by the Medipix collaboration and designed by the Microelectronics Group at CERN. Each of these detectors have 256×256 pixels with a pixel size of 55µm square with a total area of 14.08mm × 14.08mm. We will bump-bond 4 CdTe diode arrays to 4 readouts forming an array of 2x2. In addition to designing and fabricating the array, we will test and characterize these detectors in the range of 3—100 keV for applications in space and solar astrophysics.

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Table of Contents

Project Introduction 1
Primary U.S. Work Locations and Key Partners 2
Organizational Responsibility 2
Project Management 2
Technology Maturity (TRL) 3
Technology Areas 3
Target Destination 3

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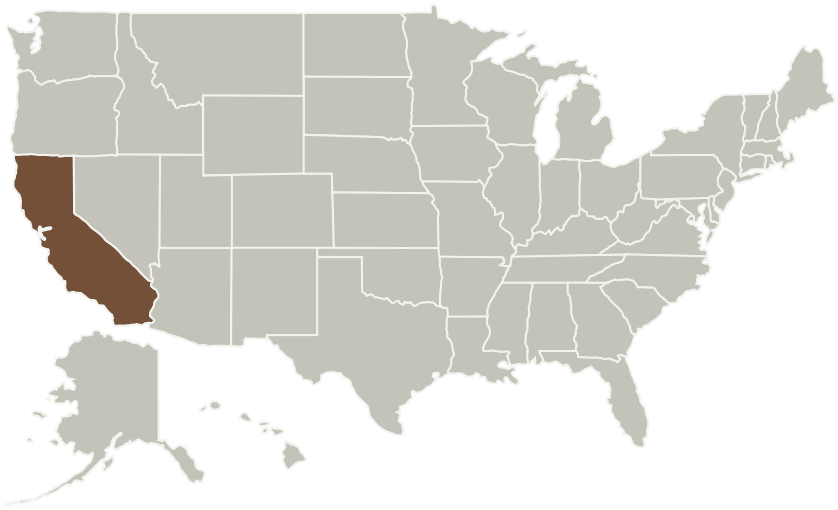
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Regents of the University of California	Lead Organization	Academia	Oakland, California
Eureka Scientific, Inc.	Supporting Organization	Industry	Oakland, California
University of California-Berkeley(Berkeley)	Supporting Organization	Academia	Berkeley, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

Regents of the University of California

Responsible Program:

Heliophysics Technology and Instrument Development for Science

Project Management

Program Director:

Roshanak Hakimzadeh

Program Manager:

Roshanak Hakimzadeh

Principal Investigator:

Juan Carlos Martinez Oliveros

Co-Investigators:

Pascal Saint-hilaire
David M Weldon
John V Vallerga
Anton S Tremsin

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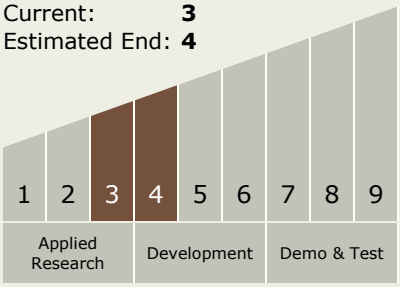
Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

The Sun